TITLE: DYNAMIC TESTING OF GASIFIER REFRACTORY

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1. ABSTRACT

Program objective:
Materials issues can often be a major hurdle in the advancement of new technologies. Refractory degradation under slagging gasifier conditions is one example. The University of North Dakota Department of Chemical engineering in partnership with the Energy & Environment Research Center is working towards a better understanding of this problem and an eventual solution for the same. The program aims to thoroughly examine the combined chemical (reaction and phase change) and physical (erosion) effects experienced by a variety of refractory materials during both normal operation and thermal cycling under slagging coal gasification conditions. The goal of this work is to devise a mechanism of refractory loss under these conditions. For this purpose, the Controlled Atmosphere Dynamic Corrodent Application Furnace (CADCAF) is being developed

Accomplishments achieved during the current period of performance:
During the current period of performance, September 28, 2003 to September 27, 2004, the installation of the CADCAF was completed. A computer controlled, reducing gas flow system has been installed along with a data acquisition system for temperature and reducing gas composition. The reducing gas will be a mixture of 2% hydrogen in pure nitrogen gas. Issues related to porosity of the furnace test chamber have been resolved. We can now maintain a positive pressure of reducing gas within the test chamber. The design and machining of acidic refractory samples has been completed. The slag-refractory interaction has been developed to accommodate all the flow patterns that may occur in the actual gasifier. Acidic slag samples are available and ready for testing. SEM analysis has been completed to evaluate the composition and structure of the refractory samples before testing.

Plans for the Remaining Period of Performance:
Refractory testing will begin immediately after CADCAF shakedown tests are completed in Spring 2004. The exposed samples will then be analyzed using SEM and XRF analysis. Basic slag and refractory samples will soon be procured.

2. LIST OF PUBLISHED JOURNALS ARTICELS, COMPLETED PRESENTATIONS AND STUDENTS RECEIVING SUPPORT FROM THE GRANT

Conference Presentations

- Shukla, D.; Mann, M.D., "Dynamic Testing of Gasifier Refractory", presented at Graduate Studies: All Things to All People – Second Annual Scholarly Activities Forum, Grand Forks, ND, Feb 11, 2003.
- Shukla, D.; Mann, M.D., "Dynamic Testing of Gasifier Refractory", presented at Living the Life of the Mind – Third Annual Scholarly Activities Forum, Grand Forks, ND, March 2-4, 2004.

Students Supported Under this Grant

- Devdutt Shukla, graduate student, Department of Chemical Engineering, University of North Dakota.
- David Klevin, undergraduate student, Department of Chemical Engineering, University of North Dakota